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## Cryocooling technology aids Hubble Telescope

*by John Brownlee, Space Vehicles Directorate*

*KIRTLAND AFB, N.M.* — If your 35mm camera goes on the blink, almost any photo repair shop in town can fix it in a few days. But when the lifetime of a highly specialized camera mounted on a research instrument aboard NASA's Hubble Space Telescope known as the Near Infrared Camera and Multi-Object Spectrometer (NICMOS) was threatened, NASA relied on elemental technology developed, in part, by the Air Force Research Laboratory's Space Vehicles Directorate, and installed it on the Hubble on March 8.

Heat-detecting infrared NICMOS sensors "see" light at very great distances, and by operating in the infrared, NICMOS can look much deeper into the clouds of dust that block normal telescope observations.

But heat in Hubble's interior produced by the routine workings of tightly compacted electronics such as computers and batteries had impaired sensor sensitivity and performance by degrading the temperature contrast needed between the sensor and its immediate background.

Consequently, the area surrounding the sensors must be cooled to about 200 degrees below zero Centigrade. It is this cold background that heightens the sensor's ability to detect faint light sources through their heat signatures or spectral "fingerprints."

Heat had leaked into a solid-nitrogen cooler known as a Dewar and melted the nitrogen faster than NASA had planned. The 4.6-year NICMOS mission would be shortened to only 1.6 years unless additional refrigeration was provided.

The Space Vehicles Directorate participated in the development of a Turbo Reverse Brayton Cryocooler, which helps NASA return the NICMOS camera to its optimum operating temperature. The Directorate supported ground test activities and provided cryocooler expertise to help define and accomplish the repair mission. The new cooler is expected to lengthen NICMOS' operational lifetime by a factor of at least two.

Over time, AFRL has made important contributions in the field of cryocooling for space systems and their sensors. This is especially significant for the warfighter of today and tomorrow. Since the Gulf War, AFRL has become increasingly dependent on reliable space-based assets for information crucial to assessing tactical as well as strategic contingencies. NASA's repair of the Hubble Space Telescope, aided by AFRL technological investments, is a real opportunity to demonstrate the pay-off of crucial Air Force technologies as they relate to space and the nation's defense.

AFRL is the Air Force center for space science and technology and teamed with NASA and other organizations to repair NICMOS.

Working contractually with Creare, Inc., of Hanover, N.H., NASA's Goddard Space Flight Center used technology developed by funds from the Missile Defense Agency and NASA.

Unimpeded by the earth's atmospheric interference like ground-based telescopes, the orbiting Hubble Space Telescope obtains extremely clear images of celestial objects and distant solar systems. @